Claims

I claim:

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1. A swim fin comprising a resilient blade member having an upper face, a lower face, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib secured to said blade member and extending substantially from said root portion toward said free end portion wherein said rib member is arranged to transfer a majority of the load created on said blade member to said shoe member during the act of swimming, said rib having a substantially rounded cross section, said rib being made with an elastomeric material having a Shore A hardness measurement that is less than 85 durometer, said rib member having sufficient resilience to permit said blade member and said rib to experience a light kick deflection of at least 10 degrees from a neutral position during a light kicking stroke wherein said deflection is measured at a tangent to said blade member taken at the midpoint along the length of said blade member, and said rib has sufficient vertical dimension to permit said material to experience an elongation range of at least said 5% along an attacking portion of said rib and experience said compression range of at least 2% along a lee portion of said rib as said rib experiences said deflection during said light kicking stroke, and said elastomeric material being capable of experiencing said elongation and said compression range during said light kicking stroke, said elastomeric material being sufficiently extensible to support a natural resonant frequency within said rib and said blade member that permits a standing wave to form along the length of said rib when a significantly high frequency short range reciprocating shoe member oscillation is applied to said shoe member, said shoe member oscillation is substantially similar to that used for a high frequency short range reciprocating kicking stroke, said standing wave forming a nodal point on said rib member between said shoe member and said free end portion, said standing wave having a root oscillating portion located between said shoe member and said nodal point, said standing wave having a free end oscillating portion located between said nodal point and said free end of said blade member, said root oscillating portion oscillates in the same direction of said shoe member, and said free end oscillating portion oscillates in the opposite direction of said root portion and said shoe member.

2. The swim fin of claim 1 wherein said vertical dimension, said elongation range, and said compression range are arranged to permit the bending resistance of said rib to increase exponentially as said rib and said blade member are deflected passed said light kick deflection experienced during said light kicking stroke as an increased load from a stronger kicking stroke is applied to said blade member, wherein said exponential increase in bending resistance occurs as

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said compression range becomes significantly used up substantially near said light kick deflection in an amount effective to create a leeward shift in the neutral bending surface within the material of said rib to create an significantly increased requirement for attacking side elongation within said material along said attacking portion of said rib as said light kick deflection is exceeded.

3. The swim fin of claim 1 wherein an increase in the energy input to said shoe member oscillation creates an amplified increase in the oscillation amplitude of said free end oscillating portion.

4. The swim fin of claim 1 wherein said deflection is selected from the group consisting of at least 10 degrees on a light kicking stroke and less than 30 degrees on a hard kicking stroke, between 10 degrees and 20 degrees on a light kicking stroke and between 30 degrees and 45 degrees on a hard kicking stroke, at least 20 degrees on a light kicking stroke and less than 45 degrees on a hard kicking stroke, less than 45 degrees during a significantly hard kicking stroke, and less than 55 degrees on a hard kicking stroke.

5. The swim fin of claim 1 wherein said deflection is significantly consistent during said light kicking strokes and during moderately strong kicking strokes.

6. The swim fin of claim 4 wherein said deflection is significantly consistent between said moderately strong kicking strokes and hard kicking strokes.

7. The swim fin of claim 1 wherein said rib is arranged to permit said deflection to be significantly maintained during hard kicking strokes, wherein said deflection is maintained in an amount effective to permit said swim fin to produce significantly high swimming speeds during said hard kicking strokes.

8. The swim fin of claim 1 wherein said rib is arranged to prevent said blade member from over deflecting during strong kicking strokes to orientations ineffective at producing significantly high swimming speeds during said strong kicking strokes.

9. The swim fin of claim 1 wherein said elongation range experienced during said deflection is selected from the group consisting of at least 7%, at least 10%, at least 15%, and at least 20%.

10. The swim fin of claim 1 wherein said compression range experienced during said deflection is selected from the group consisting of at least 5%, at least 7%, and at least 10%.

11. The swim fin of claim 5 wherein said rib is arranged to provide an exponential increase in bending resistance as said compression range is reached.

12. The swim fin of claim 1 wherein said material has sufficient memory to efficiently store energy in said material as said material experiences said elongation range and said compression range, whereby said energy storage permits said blade member to experience increased snapping motion at the inversion portion of said kicking stroke.

13. A swim fin comprising a resilient blade member having an upper face, a lower face, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib secured to said blade member and extending substantially from said root portion toward said free end portion wherein said rib member is arranged to transfer a majority of the load created on said blade member to said shoe member during a kicking stroke used during the act of swimming, said rib having a substantially rounded cross section, said rib having a Shore A hardness less than 80 durometer, said rib being made of a highly elastomeric material, said rib is sufficiently resilient to experience a deflection during said kicking stroke of least 15 degrees from a neutral blade position wherein said deflection is measured at a lengthwise tangent taken along the middle of said blade member between said shoe member and said free end portion and a significantly large portion of said deflection occurs begins near said foot pocket, said rib has a sufficiently large vertical dimension to force an attacking portion of said elastomeric material within said rib to experience an elongation range of at least 10% during said deflection and a compression range of at least 5% during said deflection.

14. A swim fin comprising a resilient blade member having an upper face, a lower face, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib secured to said blade member and extending substantially from said root portion toward said free end portion wherein said rib member is arranged to transfer a majority of the load created on said blade member to said shoe member during the act of swimming, said rib having a substantially rounded cross section, said rib having sufficient resiliency to experience significant deflection to a predetermined reduced angle of attack around a transverse axis under said load wherein said deflection is arranged to begin significantly close to said shoe member, said rib has sufficient vertical dimension and resiliency to permit said rib to experience an elongation range of at least 5% along an attacking portion of said rib and a compression range of at least 2% along a lee portion of said rib as said rib experiences

said deflection during a light kicking stroke, said vertical dimension, said elongation range, and said compression range are arranged to permit the bending resistance of said rib to increase exponentially as said predetermined angle of attack is exceeded under an increased load is applied to said blade member by a stronger kicking stroke in an attempt to increase swimming speed, wherein said exponential increase in bending resistance occurs as said compression range is exceeded in an amount effective to create a leeward shift in the neutral bending surface existing within said rib in a manner that significantly increases the requirement within said attacking portion of said rib to experience further elongation before further bending within said rib can occur, whereby said leeward shift of said neutral bending surface within said material of said rib permits significantly increased bending resistance to occur when said predetermined angle of attack is exceeded.

15. A swim fin comprising a resilient blade member having an upper face, a lower face, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib secured to said blade member and extending substantially from said root portion toward said free end portion wherein said rib member is arranged to carry a majority of the load created on said blade member during the act of swimming, said rib being made with an elastomeric material that is sufficiently extensible to support a natural resonant frequency within said rib and said blade member that permits a standing wave to form along the length of said rib when a significantly high frequency short range reciprocating shoe member oscillation is applied to said shoe member, said shoe member oscillation is similar to that used for a high frequency short range reciprocating kicking stroke, said standing wave forming a nodal point located between said shoe member and said free end portion, said standing wave having a root oscillating portion located between said shoe member and said nodal point, said standing wave having a free end oscillating portion located between said nodal point and said standing wave, said root oscillating portion oscillates in the same direction of said shoe member, said free end oscillating portion oscillates in the opposite direction of said root portion and said shoe member, said rib has sufficient resiliency and sufficient vertical dimension to permit said rib to experience at least 5% elongation and at least 2% compression as said rib experiences said deflection during said light kicking stroke, whereby said vertical dimension, said elongation range and said compression range are arranged to increase the snapping motion of said free end portion at the inversion point of said kicking stroke.

16. The swim fin of claim 14 wherein said vertical dimension, said elongation range, and said compression range are arranged to permit the bending resistance of said rib to increase

exponentially as said load on said rib and said blade member is increased from a light kicking stroke to a heavy kicking stroke, whereby said exponential increase in bending resistance occurs in an amount effective to permit said blade member to maintain orientations capable of producing significantly high speeds during said act of swimming.

17. A swim fin comprising a resilient blade member having an upper face, a lower face, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib secured to said blade member and extending substantially from said root portion toward said free end portion wherein said rib member is arranged to transfer a majority of the load created on said blade member to said shoe member during the act of swimming, said rib being made with an elastomeric material that is sufficiently extensible to support a predetermined natural resonant frequency within said rib and said blade member that is arranged to permit a standing wave to form along the length of said rib when reciprocating shoe member oscillation is applied to said shoe member at a predetermined reciprocating frequency, said standing wave forming a nodal point located between said shoe member and said free end portion, said standing wave having a root oscillating portion located between said shoe member and said nodal point, said standing wave having a free end oscillating portion located between said nodal point and said free end portion, said root oscillating portion oscillates in the same direction of said shoe member, said free end oscillating portion oscillates in the opposite direction of said root portion and said shoe member, said rib has sufficient resiliency and sufficient vertical dimension to permit said rib to experience an elongation range of at least 5% along an attacking portion of said rib and a compression range of at least 2% along a lee portion of said rib as said rib experiences said deflection during said light kicking stroke, whereby said vertical dimension, said elongation range and said compression range are arranged to increase the snapping motion of said free end portion at the inversion point of said kicking stroke.

18. A hydrofoil comprising a moveable blade member having opposing faces, outer side edges, a root portion, a free end portion, said root portion secured to a predetermined body wherein said body is arranged to provide a reciprocating propulsion oscillation to said blade member at a predetermined reciprocating frequency, and at least one resilient elongated rib secured to said blade member and extending substantially from said root portion toward said free end portion wherein said rib member is arranged to transfer a majority of the load created on said blade member created by said reciprocating oscillation to said predetermined body, said rib member having sufficient resilience to permit said blade member and said rib to experience a deflection of at least 10 degrees from a neutral position to a predetermined reduced angle of attack under the

load created during said reciprocating oscillation wherein said deflection is measured at a tangent to said rib taken at the midpoint along the length of said rib, and said rib has sufficient vertical dimension and sufficient extensibility to permit said rib to experience and elongation range of at least 5% along an attacking portion of said rib and a compression range of at least 2% along a lee portion of said rib as said rib experiences said deflection during said reciprocating oscillation, said rib and said elastomeric material being arranged to support a natural resonant frequency within said rib and said blade member that is sufficiently close to the frequency of the shock wave generated on said blade member at the inversion portion of said reciprocating oscillation to permit said shock wave to become significantly amplified through constructive wave addition with said resonant frequency, whereby said constructive wave addition creates an amplified oscillation in said free end portion of said blade member.

19. A swim fin comprising a resilient blade member having opposing faces, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib extending substantially from said root portion toward said free end portion wherein said rib member is arranged to carry a majority of the load created on said blade member during the act of swimming, said rib having sufficient transverse dimension to significantly prevent said rib from buckling under said load during said act of swimming, said rib being made with an elastomeric material having a Shore A hardness measurement less than 85 durometer, said rib member having sufficient resilience to permit said blade member and said rib to experience a light kick deflection of at least 10 degrees from a neutral position during a light kicking stroke wherein said deflection is measured at a tangent to said blade member taken at the midpoint along the length of said blade member, and said rib has sufficient vertical dimension and horizontal dimension to cause said rib to experience at least 5% elongation and at least 2% compression as said rib experiences said deflection during said light kicking stroke, and said elastomeric material being capable of experiencing at least said 5% elongation and said 2% compression during said light kick deflection.

20. A swim fin comprising a resilient blade member having opposing faces, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib extending substantially from said root portion toward said free end portion wherein said rib member is arranged to carry a majority of the load created on said blade member during the act of swimming, said rib having a substantially rounded cross section with sufficient transverse dimension to significantly prevent said rib from buckling under said load during said act of swimming, said rib being made with an elastomeric material having a

Shore A hardness measurement less than 85 durometer, said rib is sufficiently resilient to experience a deflection to a predetermined reduced angle of attack around a transverse axis under said load, said rib having sufficient horizontal dimension, sufficient transverse dimension, and sufficient extensibility to permit said rib to experience an elongation range of at least 5% along an attacking portion of said rib and experience a compression range of at least 2% along a lee portion of said rib as said rib experiences said deflection during under said load, said shoe member is subjected to a shoe member reciprocating oscillation that oscillates at a predetermined kicking range and a predetermined kicking frequency, said elastomeric material being sufficiently extensible to support a natural resonant frequency within said rib and said blade member that is sufficiently similar to said predetermined kicking frequency to permits a standing wave to form along the length of said rib as said predetermined kicking frequency causes said rib and said blade member to resonate at a harmonic of said natural resonant frequency, said standing wave forming a nodal point located between said shoe member and said free end portion, said standing wave having a root oscillating portion located between said shoe member and said nodal point, said standing wave having a free end oscillating portion located between said nodal point and said free end portion, said root oscillating portion oscillates in the same direction of said shoe member, said free end oscillating portion oscillates in the opposite direction of said root portion and said shoe member.

21. The swim fin of claim 20 wherein said vertical dimension, said elongation range, and said compression range are arranged to permit the bending resistance of said rib to increase exponentially as said rib and said blade member are deflected passed said light kick deflection experienced during said light kicking stroke as an increased load from a stronger kicking stroke is applied to said blade member, wherein said exponential increase in bending resistance occurs as said compression range becomes limited substantially near said light kick deflection in an amount effective to create a leeward shift in the neutral bending surface within the material of said rib thereby creating an exponentially increased requirement for attacking side elongation within said material of said rib.

22. A swim fin comprising a resilient blade member having opposing faces, outer side edges, a root portion, a free end portion, a shoe member secured to said root portion of said blade member, and at least one resilient elongated rib extending substantially from said root portion toward said free end portion wherein said rib member is arranged to carry a majority of the load created on said blade member during the act of swimming, said rib having a substantially rounded cross section,

said rib being made with an elastomeric material having a Shore A hardness measurement less than 85 durometer, said rib member having sufficient resilience to permit said blade member and said rib to experience a light kick deflection of at least 10 degrees from a neutral position during a light kicking stroke wherein said deflection is measured at a tangent to said blade member taken at the midpoint along the length of said blade member, and said rib has sufficient vertical dimension to permit said rib to experience at least 5% elongation and at least 2% compression as said rib experiences said deflection during said light kicking stroke, and said elastomeric material being capable of experiencing at least said 5% elongation and said 2% compression during said light kicking stroke, said elastomeric material being sufficiently extensible to support a natural resonant frequency within said rib and said blade member that permits a standing wave to form along the length of said rib when a significantly high frequency short range reciprocating shoe member oscillation is applied to said shoe member, said shoe member oscillation is similar to that used for a high frequency short range reciprocating kicking stroke, said standing wave forming a nodal point located between said shoe member and said free end portion, said standing wave having a root oscillating portion located between said shoe member and said nodal point, said standing wave having a free end oscillating portion located between said nodal point and said standing wave, said root oscillating portion oscillates in the same direction of said shoe member, said free end oscillating portion oscillates in the opposite direction of said root portion and said shoe member.

23. The swim fin of claim 22 wherein said vertical dimension, said elongation range, and said compression range are arranged to permit the bending resistance of said rib to increase exponentially as said rib and said blade member are deflected passed said light kick deflection experienced during said light kicking stroke as an increased load from a stronger kicking stroke is applied to said blade member, wherein said exponential increase in bending resistance occurs as said compression range becomes limited substantially near said light kick deflection in an amount effective to create a leeward shift in the neutral bending surface within the material of said rib thereby creating an exponentially increased requirement for attacking side elongation within said material of said rib.

24. A method for creating significantly consistent hydrofoil deflections, comprising:
   (a) providing said hydrofoil with a blade member having two opposing surfaces, outer side edges, a root portion secured to a predetermined body, a free end portion spaced from said root portion and said predetermined body,

(b) providing said blade member with relative movement to a surrounding water medium in a manner that creates an attacking portion of said blade member and a lee portion of said blade member,

(c) providing said blade member with an elastomeric load bearing material having sufficient elastomeric resilience to permit said blade member to experience a light load deflection to a predetermined light load reduced angle of attack from a neutral blade position during significantly light load conditions created by said relative movement, wherein said light load deflection is at least 10 degrees from neutral blade position and said light load deflection is measured from a lengthwise tangent to said blade member at a midpoint between said root portion and said free end portion,

(d) providing said blade member with sufficient vertical dimension and sufficient extensibility to permit said blade member to experience a light kick elongation range of at least 5% along an attacking portion of said blade member during said light load deflection,

(e) providing said blade member with sufficient vertical dimension and sufficient extensibility to permit said blade member to experience a light kick compression range of at least 2% along an attacking portion of said blade member during said light load deflection,

(f) providing said blade member with sufficient transverse dimension to permit said blade member to substantially maintain orientations effective in generating said elongation range and said compression range,

(g) arranging said vertical dimension, said transverse dimension, said elongation range and said compression range to permit said blade member to experience a significantly exponential increase in bending resistance as said blade member is deflected beyond said light load deflection, wherein said increase in bending resistance is created by a shift in position of the neutral bending surface within said blade member toward said lee surface as said blade member is deflected passed said light load deflection, whereby said blade member is able to experience exponential increases in bending resistance as said blade member is deflected passed said light load deflection with increased loading conditions.

25. A method for creating significantly consistent hydrofoil deflections, comprising:

(a) providing said hydrofoil with a blade member having two opposing surfaces, outer side edges, a root portion secured to a predetermined body, a free end portion spaced from said root portion and said predetermined body,

(b) providing said blade member with relative movement to a surrounding water medium in a manner that creates an attacking portion of said blade member and a lee portion of said blade member,

(c) providing said blade member with an elastomeric load bearing material having sufficient elastomeric resilience to permit said blade member to experience a light load deflection to a predetermined light load reduced angle of attack from a neutral blade position during significantly light load conditions created by said relative movement, wherein said light load deflection is at least 10 degrees from a neutral blade position and said light load deflection is measured from a lengthwise tangent to said blade member at a midpoint between said root portion and said free end portion,

(d) providing said blade member with sufficient vertical dimension and sufficient extensibility to permit said blade member to experience a predetermined light load elongation range of at least 5% along an attacking portion of said blade member during said light load deflection, and providing said blade member with sufficient vertical dimension and sufficient compressibility to permit said blade member to experience a predetermined light kick compression range of at least 2% along an attacking portion of said blade member during said light load deflection,

(e) providing said blade member with sufficient transverse dimension to permit said blade member to significantly maintain orientations effective in generating said elongation range and said compression range,

(f) arranging said vertical dimension, ~~said transverse~~ dimension, said elongation range, and said compression range to permit said blade member to experience a significantly exponential increase in bending resistance ~~as said~~ blade member is deflected beyond said light load deflection to an increased load deflection, wherein said light kick compression range is exceeded in an amount effective to cause the neutral bending surface existing within said blade member to experience a significant shift in position toward said lee surface from a light load neutral bending surface location to an increased load neutral bending surface location, whereby said shift creates a proportionally large increase in the degree to that said light load elongation range must be exceeded in order to permit said blade member to bend to said increased load deflection.